Claims

1. A method for acquisition of shapes from images with representations of HEp-2 cell sections as objects and for learning abstract shape models from representations of HEp-2 cell sections for a case database for a case-based recognition of HEp-2 cells in digital images, characterized in that for each image by manual tracing of edges of an image in the form of visible outer and/or inner contours of HEp-2 cells by means of a hand-held input device connected to a computer data are acquired that can be correlated with these edges and the HEp-2 cells as objects represented thereby, that the translation of each object is eliminated such that each object is moved into the origin of a coordinate system, that each object in accordance with the correlated data is scaled within the coordinate system, that at least two objects are compared with one another, respectively, that the objects are oriented toward one another, wherein in this connection scaling and/or rotation is carried out, that at the same time the similarity is calculated, that during calculation of the similarity the similarity parameters are determined either as distance values or similarity values between the objects, respectively, until either a minimum of the distance values or a maximum of the similarity values is present, that based on the determined distance values or similarity values sets of similar objects are formed and hierarchically ordered as a dendogram, and that the dendogram by presetting distance values or similarity values is divided into groups and within the groups one prototype is selected, respectively, wherein the prototype either is an averaged shape averaged based on individual shapes of the group or the median of the group of the individual shapes.

2. The method according to claim 1, characterized in that the distance values or the similarity values define a distance matrix or a similarity matrix.

3. The method according to claim 1, characterized in that the distance values or the similarity values are hierarchically represented by means of the single linkage method and a dendogram.

4. A method for acquisition of shapes from images with representations of HEp-2 cell sections as cases and for case-based recognition of HEp-2 cells as objects in digital images, characterized in that

- on the one hand, for acquisition of shapes from images with cases and for learning abstract shape models based on these cases for a case database, for each image with cases data are acquired by manual tracing of edges of an image in the form of visible outer and/or inner contours with a handheld input device connected to a computer which data can be correlated with these edges and thus cases; at least two cases are compared with one another, respectively, by means of moving and scaling for each case; the two cases are oriented toward one another and in this connection at the same time the similarity is calculated by determination of similarity parameters; in accordance with the similarity parameters, sets of similar cases are formed and ordered hierarchically as a dendogram; the dendogram, by presetting distance values or similarity values, is divided into groups and within the groups a prototype is selected;

- on the other hand, for recognition of an object in a digital image with objects from the case database a case is selected as a case image with a case description, wherein at the same time an image sequence is generated of the case image as a pyramid with image planes; a gradient image of the actual digital image is generated and is transformed into an image sequence as a pyramid with image planes; the case image is successively moved onto each object image of the gradient image beginning with the highest image planes wherein the case image is compared to each object image of the gradient image and in this connection at the same time the similarity is calculated by determination of similarity parameters, and the degree of similarity between case image and object image is determined by the similarity parameter.

5. The method according to claim 4, characterized in that the translation of each case is eliminated such that each case is moved into the origin of a coordinate system, that each case in accordance with the correlated data is scaled within the coordinate system, that at least two cases are compared with one another,

respectively, that the cases are oriented toward one another, wherein in this connection scaling and/or rotation is performed, that at the same time the similarity is calculated, that during calculation of the similarity the similarity parameters are determined either as distance values or similarity values between the cases, respectively, until either a minimum of the distance values or a maximum of the similarity values is present, that based on the determined distance values or similarity values sets of similar cases are formed and ordered hierarchically as a dendogram, and that the dendogram by presetting distance values or similarity values is divided into groups and within the groups a prototype is selected, respectively, wherein the prototype is either an averaged shape that is averaged based on the individual shapes of the group or the median of the group of the individual shapes.

6. The method according to claim 1 or 4, characterized in that the dendogram is intersected once on the similarity scale in accordance with either at least one fixed, and thus automatic, or at least one user-specific threshold so that groups result, that the individual forms are correlated with the groups, that in the groups one prototype is selected, respectively, wherein the prototype is either an averaged shape that is averaged based on the individual shapes of the group or the median of the group of the individual shapes, that the averaged shape or the median of group is represented on a or the data viewing device, and that the contour points of the averaged shape or the median is saved as a data set in the computer.

7. The method according to claim 1 or 4, characterized in that a reduction of the data acquired by tracing the edges and thus of the points as the visible outer and/or inner contours is realized by interpolation with a polynomial.

8. The method according to claim 1 or 4, characterized in that the data of the objects are standardized such that the center point of the object corresponds to the coordinate origin 0, 0.

9. The method according to claim 4, characterized in that a case image with a case description is selected from the case database, wherein subsequently or simultaneously an image sequence is generated from the case image as a pyramid with image planes, that a gradient image of the actual digital image is generated and is transformed into an image sequence as a pyramid with image planes, that the case image is successively moved onto each object image of the gradient image beginning with the highest image planes, wherein the case image is compared with each object image of the gradient image, that the case image is oriented toward the object image wherein in this connection scaling and/or rotation of the case image is carried out, that at the same time the similarity is calculated, that during the calculation of the similarity the similarity parameters are determined either as distance values or similarity values between the case image and the object image, respectively, until either a minimum of the distance values or a maximum of the similarity values is present, and that the degree of similarity between case image and object image is determined by the similarity parameter such that the degree of similarity decreases with decreasing similarity parameter and the object image becomes less similar to the case image.

10. The method according to claim 4, characterized in that by means of an edge detection of the objects of the digital image the gradient image is generated, that gradients are correlated with large changes of the grayscale value in the vertical direction as well as in the horizontal direction, respectively, and no gradient is correlated with homogenous surfaces so that the homogenous surfaces are black.

11. The method according to claim 1 or 4, characterized in that a gradient image is formed based on the case image as well as the object image, respectively, that these gradient images each are transformed into an image sequence as a pyramid with image planes and that successively the directional vectors in the image planes of the case image and the object image are compared with one another by forming the product.

12. The method according to claim 1 or 4, characterized in that the case image is a prototype of the individual shapes of a group of either averaged shape or the median of the group of individual cases, wherein groups are sets of similar individual cases ordered as a dendogram with determined distance values or similarity values and the most similar case determines the branch of the dendogram or that the case image is an individual image of a case.

13. The method according to claim 1 or 4, characterized in that the directional vector between either two points or neighboring points of the edges is calculated for the case image or will be calculated for the object image and that during the calculation of the similarity the similarity parameters are determined as directional vectors as well as either as distance values or similarity values between the case image and the object image, respectively.

14. The method according to claim 1 or 4, characterized in that by means of an index the cases are ordered in the case database in accordance with the similarity relations such that from a set either of prototypes the most similar prototype or of cases the most similar case can be found quickly for the object in the image.

15. The method according to claim 1 or 4, characterized in that the calculation of similarity is done based on

$$D(P,O) = \sum_{i=1}^{N} \left| \frac{(p_i-\mu_p)}{\delta_p} - R(\Theta) \frac{(o_i-\mu_o)}{\delta_o} \right|^2$$

P, O - objects

Θ - rotation matrix

μ_p and μ_o - center points of the objects P and O

δ_p and δ_o - the sums of the squared spacings of each point from the center points.

16. The method according to claims 4 and 5, characterized in that the degree of similarity and thus the identity between case image and object image is determined by the similarity parameter and represents a threshold value and that a non-identical object relative to the case is either refused or is represented as a case on the data viewing device so that by means of manual determination and by manual tracing of edges in the form of visible outer and/or inner contours with the hand-held input device connected to the computer data are acquired that can be correlated with these edges and thus the case and can be correlated with the dendogram with the determined cases.

17. A computer program product with a program code either for performing the method for acquisition of shapes from images with representations of HEp-2 cell sections as objects and for learning abstract shape models of represented HEp-2 cells according to claim 1 or for performing the method for acquisition of shapes from images with cases and for case-based recognition of objects in digital images according to claim 4, when the program is running on a computer.

18. A computer program product with a machine-readable carrier either for performing the method for acquisition of shapes from images with representations of HEp-2 cells as objects and for learning abstract shape models of representations of HEp-2 cell sections according to claim 1 or for performing the method for acquisition of shapes from images with cases and for case-based recognition of objects in digital images according to claim 4, when the program is running on a computer.

19. A digital storage medium either according to claim 1 that can interact with a programmable computer system such that a method for acquisition of shapes from images with representations of HEp-2 cells as objects and for learning abstract shape models of representations of HEp-2 cell sections according to claim 1, or

according to claim 4 that can interact with a programmable computer system such that a method for acquisition of shapes from images with cases and for case-based recognition of objects in digital images according to claim 4 is carried out.